

## Seedbed Management

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**Location** - Find the proposed site on a county Soil Survey map. Select a deep, well drained silt loam soil, without a fragic pan. Select a spot where water does not flow across; eroding soil, or depositing weed seed, disease organisms, or nematodes.

The local UT Extension office staff can assist in taking a soil sample and a nematode sample before construction begins. The soil test provides the pH, available phosphorus, and potassium levels. Pay an extra \$3 for the available calcium and magnesium levels. (Useful if growing hemlock seedlings.)

Will you utilize natural shade or build the beds in full sun and erect shade? Fumigation will eventually damage or kill tree roots that come into the bed for moisture.

The beds should be oriented in an East-West direction, if lath will be used to provide shade, otherwise the direction may be dictated by the slope.

**Construction** - Three to five feet is a common width, but the width is really determined by the equipment to be used (a bed lifter, power tiller), the method employed to erect shade, or grower preference. The sides can be cross-ties, 2 x 8's, 1 x 6 white oak, or pressure treated lumber, etc. Build the beds up 6-8 inches, crown them, with the center higher, and sloping sides to facilitate drainage. The walkway width and construction varies with preference and available space.

Each bed should be level from one end to the other, to promote even moisture from irrigation lines. Terraces should be constructed on slopes.

**Media** - Add 2 to 3 inches of 3/8 to 1/2 inch particle size pine bark and roto-till it in to the existing native soil. Repeat this step with an additional 2 to 3 inches of pine bark. Do not add sand. Sand is used in concrete. A mix greater than 50 percent sand is required to increase the internal drainage. Organic matter helps hold moisture and nutrients and provides aeration. Work the top 6 to 8 inches.

**Nutrition** - Based on soil test results, broadcast the required amount of lime for the intended crop and enough phosphate and potassium to raise the soil test levels to medium for each bed. **Add no Nitrogen.** Roto-till in. Request the recommendations to be provided in rates per 100 sq ft or ask your local extension office or Nursery Specialist to assist in converting the rates from per acre to per 100 sq. ft. rates.

**Fumigation** – Unfortunately, the availability of Methyl Bromide tapered off between 2000 and 2005 or so. It had been the fumigant of choice. It killed all pathogens, insects and seed except for the hard seeded clovers, vetch, nutsedge, etc. While effective, some producers considered it dangerous to use and it was, like guns, cars and aspirin.

We have had to learn how to use Basamid Granular and accept its shortcomings. It is a soil fumigant. Click here to view a label. <http://www.cdms.net/LDat/ld7PI003.pdf>

On a scale of 1 to 10 with 10 being equal to Methyl Bromide, Basamid is an 8 or 9 generally. Basamid also does not control morning-glory, vetch, white clover, nutsedge, and other hard seeds. In terms of insects, diseases and nematodes, Basamid would be a 0 to an 8 depending on the target organism. Sanitation is critical to reduce plant losses.

Basamid is not as forgiving as Methyl Bromide in that Basamid requires good to excellent soil moisture (as the granular reacts with water to produce the fumigating gases including MITC and Hydrogen Sulfide) and the rate of gas loss from the soil is influenced by soil temperature (vapor pressure of MB is not influenced by temperature, MITC at soil temperatures less than 55 - 50 degrees F switches from wanting to be a gas to wanting to be a liquid and as a result 'sits' in the soil for a long time (months - unless the soil or media is loosen and exposed to the air).

So in short, if Basamid is applied correctly it does a very amazing job on the same weeds controlled by Methyl Bromide. But the criteria for successful application are more rigid.

Fumigate (gas) the beds after the fertilizer and lime has been roto-tilled in. Fumigation is better when the soil temperature is 50 to 60 degrees F for effective control and convenience. Spring treatments are hampered by cold soil temperatures and wet weather. Fall (Sept-Oct or earlier) fumigation is generally preferred because soil temperatures are higher and there are more periods of suitable weather for treatment.

The bed should have good moisture for 5-14 days prior to using Basamid. The soil or sand or pine bark media should be in good working condition. Remove all plant (weeds, roots) debris. Rototill immediately before fumigating to fluff the soil, so that better penetration of the gas is achieved. Remove clods. Basamid should be applied at the rate of 1 to 1.5 pounds per 100 square feet of bed space. Once Basamid is applied the following steps must be done the same day.

Use a drop spreader to spread the correct amount evenly over the bed surface. Rototill the bed to incorporate the granules into the media of the bed evenly to a 4 inch depth. A roller is helpful to seal the gas in after raking the surface smooth. Then thoroughly wet the surface, keeping it moist but not waterlogged for 72 hours. Consider covering the bed with a sheet of poly to retain the gas vapors and prevent critters from walking over the surface. This would be maximum effort. The label provides a good explanation on pg 3-4.

While the drop spreader is only used for a few minutes, it's functionally is critical. It is critical that the gate opening works easily and efficiently; that the wheels and axle are strong and can be pushed through the soft media. A rope can be attached to allow someone to actually pull the spreader and keep it moving steady in a straight line. Beds are generally four feet wide and spreaders are frequently three feet wide. Cover the outside foot with duck tape across the bottom. Make a pass down and back. The tiller, wheels, boots and any tools should be clean and free of dirt that could hide diseases and seed. Sanitation is critical.

If you choose to do the maximum effort and cover with poly, figure out how to seal the edges to make it as air tight as possible. Tacking it with wood strips to the top of the timbers is not sufficient. Bringing the poly over the timbers and burying the edge in a trench dug in the walkway is better. It might be necessary to bury the back side and ends of the poly inside the bed.

A soil thermometer is required to know what the soil temperature is and then how long to wait until removing the poly cover or how long to wait before planting seed. Refer to the label. The label suggests waiting 8 days when the soil is 77 degrees F at a 4 inch depth; 11 days for 68 degrees; 15 days for 59 degrees; 24 days for a 50 degree soil; 47 days for a 41 degree soil.

Remove the cover and rake lightly (no more than two inches deep) to help aerate soil (to encourage the gas to leave). Wash the rake first. Do not step into the bed. Do not work deeper than the gas penetrated. This aeration process can require 2 to 20 days depending on the soil temperature. Refer to the label. Any remaining gas can be harmful and kill germinating seed, after all that is what you brought it to do.

If the beds are constructed under natural shade, fumigation will kill or damage any tree roots that it comes in contact with over time. Once fumigated, do not walk into the bed, or add anything non-sterile to it. Never, ever prop a foot in the bed or on the boards.

We feel we must recommend fumigation prior to each crop. It's a lot of trouble, but a grower cannot afford the loss of a bed due to disease or grass. Seed are very expensive and are scarce some years; or a grower may have the seedlings sold (before the bed is planted).

**Seed Source** - Our southern collected seed will grow a nice quality plant, but that plant will not be as winter hardy when shipped north as if produced from northern collected seed. Northern collected seed do not produce seedlings that grow as well as our southern born seedlings. If our northern friends comment that a certain plant is not winter hardy, then perhaps we should grow the next plants from northern collected seed.

**Seeding** - Seeding can be done by hand into rows within the bed, or broadcast over the bed. Mix the seed with a sterile carrier such as peat moss, sand, etc. If broadcasting, sow half the seed while moving north to south and the other half while moving east to west. Remember not to walk within the sterile bed.

**Seed Density** - Proper spacing is essential. Overcrowding will produce weak seedlings that will be difficult to transplant or they may remain stunted. The sowing rate is determined by considering:

- 1) the desired density
- 2) the seed viability (at the time of sowing)
- 3) the survival rate expected, based on probable losses from disease, frost, drought, birds, skunks, moles, bad luck, past experiences, etc.
- 4) the number of seed per pound.

The sowing rate is very hard to generalize. All seeds are different. A grower must experiment and record what is done to learn the best density for each species for himself. Some of our growers have learned that 20 White Pine and 40-50 Hemlock seed per square foot is okay for them. Refer to references #2 and 3.

**Seed Depth** - The general rule is to cover seed twice as deep as their diameter. Seed should be firmed into the soil surface to establish good seed to soil contact. This should be uniformly done to avoid places where water may settle. Rollers are most frequently used, either hand pulled, or tractor pulled. A sheet of plywood laid across the bed and lightly walked on has also been successful, but that will destroy the crown that is critical for drainage. Be aware of sanitation.

Cover conifer seed with 1/4 to 1/2 inch of peat moss. Other choices are rotten sawdust, or pine needles to prevent soil crusting. One successful local hemlock producer lays 47-50% shade cloth immediately flat on top of the quarter inch of peat moss. It is pinned down to prevent the wind from blowing it all away and to stop birds. The cloth is later draped over supports that are constructed above the bed as germination begins. The sides hang to the soil to stop birds and the late afternoon sun.

**Summer Care** - Thirty to fifty percent shade is needed depending on the species and the elevation to reduce drying and sunscald. A common practice is to drape the shade cloth over a wood frame, wood and wire frame, or 5 gauge concrete reinforcement wire (6 inch x 6 inch mesh). The cloth should hang all the way to the soil and be secured along the bottom to keep birds out.

Generally, deciduous tree seedlings such as dogwood, oak, birch, and maples are not shaded, but growers in hotter areas do use 25-33 percent shade with red maple. Conifers require 47-50 percent shade in middle Tennessee, removed in September and replaced the following summer.

**Moisture** - Irrigation is essential. Irrigate immediately after seeding. Once germination begins the seedlings must not be allowed to dry out or the tiny seedlings will quickly die. The droplet size can be larger than that required for cuttings, due to the presence of roots. Watering can be done with a garden hose, sprinklers, or even a time-clock controlled system.

**Grass & Weed Control** - Fumigation prevents most of the unwanted vegetation. Timely hand weeding can take care of the escapes. Infrequent hand weeding exposes

seedling roots to drying air when large weeds are pulled. It will be easier and better to perform this task twice a week.

Very few herbicides are labeled for use in seedbeds. Check with the UT Extension Area Nursery Specialist in case of changes. The herbicide Goal can be used on pine, spruce, and hemlock seed beds after seeding, but before germination. Goal will prevent some grass and weed seed germination for 1-3 months. Goal will burn new tender weed growth. Goal can be used on all labeled conifers in March before tender growth and again in late June or early July when the new growth hardens-off. Hemlock is the exception, because it keeps growing. Goal can be used on Hemlock only in March, prior to new growth.

Ronstar is labeled for some seedling crops (Eastern White Pine seedlings that are at least 4 weeks old). Devrinol works fairly good. Envoy Plus, Fusilade T/O or Segment (formerly Vantage) can be sprayed over labeled plants to kill green grass only. Check labels.

**Summer Fertilization** - No fertilizer should be topdressed until germination is complete. Refer to the Nutrition section on page 1. Conifers should be fertilized when the terminal bud has set, probably in mid June. Apply nitrogen at the rate of 40-50 pounds nitrogen per acre.

**50 pounds of actual Nitrogen per acre can be supplied by:**

analysis	<u>lbs/acre</u>	lbs/1000 sq. feet or <u>row feet</u>	Oz./100 sq ft or <u>row feet</u>	Cups per 100 <u>sq ft</u>
34- 0- 0	150	3.5	5.6	0.75
27-4-10	185	4.2	6.8	??
20-10-10	250	5.7	9.2	1.5
18-46-0	275	6.3	10.1	1.75
15-15-15	333	7.6	12.1	2
13-13-13	385	8.7	14	2
10-10-10	500	11.4	18.4	3

One application per year of a controlled-release fertilizer (CRF) is better and safer at the 50 pound rate of actual nitrogen per acre than trying to use calcium nitrate or ammonium nitrate. These materials cost more, but they may prevent the death of tender, high value seedlings, due to over or uneven application with ammonium nitrate and provide a more even growth rate. When selecting a CRF consider the longevity of the product and the time of year it is being applied. (Use a 12 to 14 month CRF in late winter to late April; an 8 to 9 month CRF material in April to June or July; and use a 3 to 4 month after late July.) Select a CRF with minors.

CRF labels suggest a low, medium or high rate based on the plants fertility requirement (or salt tolerance). Select either the low or medium rate. Plants can be successfully

grown with lower rates of fertilizer if irrigated conservatively to minimize leaching. This can be achieved with overhead irrigation if cyclic applications are used.

Fertilize conifer seedbeds the second year with the same rate of nitrogen. If ammonium nitrate is used, apply it several times during the year; beginning 4-6 weeks before the spring flush of growth (February), and every 6 weeks until mid-July. If a controlled-release fertilizer is selected, apply a 12 month release 4-6 weeks before the spring flush.

Farm grade Rainbow 13-13-13 with minors is an alternative but too much can burn the foliage because the fertilizer releases rapidly. Consider spreading 1 cup/100 sq ft twice during the summer but no later than July 1.

Liquid fertilizer applications may be made up until Sept 15 without injury most years. 100 to 150 ppm of 20-20-20 (7 to 10 oz/100 gallon) should be adequate. Use less after a dry fertilizer is added. Small plants will not need much. Avoid tank mixing with pesticides the first year because of potential for foliar burn (phytotoxicity).

**Wildlife Problems** – Exculsion is generally the best approach. Wildlife issues are always more difficult after the critters have gotten use to feeding easily on your fruits. Erect fences before planting the seed. Moles - Try windmills, mole traps or a hardware cloth bottom in the bed. Rabbits - Construct chicken wire around the perimeter. Dogs - Erect an electric fence around the perimeter. Must avoid damage during fumigation and also to protect trespassers from the fumigant. Artificial owls can be set on posts and moved every 3 days to scare birds and squirrels. Maybe. Shade cloth can also provide protection from birds, etc, depending on how it is used. Beds under Quonset frames can be made more secure from wildlife.

**Disease Prevention** - A preventative program approach can be taken with a drench of Cleary's 3336F, Captan, Subdue MAXX, Banrot, or Truban periodically. Botrysis or Gray Mold can attack conifer seedbeds and can be prevented or controlled with Cleary's 3336F, Ornalin, Daconil 2787, Chipco 26019 or Exotherm Termil in a greenhouse.

Dogwood and hemlock seedling diseases consist primarily of DAMPING-OFF. Damping-off is caused primarily by fungi of Rhizoctonia, Cylindrocladium, Pythium, Fusarium, Phytophthora, or Sclerotium. Any one or more of these fungi may be present in a seedbed (in most soils). Germinating seed and seedlings, especially weak ones, are vulnerable to attack by these fungi during periods of unfavorable growing conditions. Species of Pythium and Phytophthora cause problems in cool wet soils. Rhizoctonia, Fusarium, and Southern blight (Sclerotium) are favored by warmer, drier conditions.

Typical symptoms of DAMPING-OFF are rotting stems at or near the soil line and root decay. Affected areas in the seedbed are usually a foot or more in diameter with shriveled brown, collapsed or stunted seedlings. Moldy growth may or may not be seen. Germinating seed can also be attacked by these fungi before they emerge from the soil, resulting in poor stands.

The best control of DAMPING-OFF is to avoid it altogether: 1) Proper bed/soil preparation and management to provide for good drainage, soil structure, aeration, water-holding capacity, and plant nutrition by including proper amounts of fertilizer and lime according to the soil test report; 2) fumigation; 3) proper seeding rates to avoid thick plant populations, poor air movement and low light intensity; and 4) strict sanitation to avoid re-infesting treated soil with disease-causing organisms. (Don't walk on the bed once it is fumigated.)

A drench of Cleary's 3336F plus Subdue MAXX is very effective in preventing Damping-off: **20 fl oz Cleary's 3336F plus 1/2 fl oz Subdue MAXX\* in 100 gal. of water.**

or 10 fl. oz. Cleary's 3336F plus 1.5 tsp. Subdue MAXX\* in **50** gallons of water.

or 5 fl. oz. Cleary's 3336F plus 3/4 tsp. Subdue MAXX\* in **25** gallons of water.  
1.5 ml / **10** gal; 0.75 ml or cc / **5** gal.; 7 drops / **1** gallon.

Cleary's can be repeated at 4 week intervals unless a problem is discovered. Then go to a 2 week interval. Subdue MAXX can be repeated every 2 months, but normally only 1 application is required. (An alternative to the Cleary's and Subdue MAXX is 6 ounces **Banrot** 40WP in 100 gallons of water. Repeat in 6 weeks.) Drench (water) beds at the rate of 1-2 pints per square foot of bed space, using one of the above solutions.

\*Euonymus should not be treated with Subdue MAXX.

**Winter Care** - After planting conifer seed, and after one hard freeze, mulch the bed with six inches of pine needles or wheat straw. Check occasionally. Root prune dogwood and oak seedlings in November or December to induce a larger root system. This produces a better quality liner.

**Harvest** - Conifer seedlings (hemlock) may need to be lifted and planted into a transplant or liner bed for another year or two. Use a 4 inch x 6 inch spacing for conifers moved to a transplant bed. Don't allow the roots to dry out during the process. Grade and plant them by size. This helps when a perspective buyer visits and finds uniformity. Transplant conifers into a liner bed during the fall. Mulch after a hard freeze.

### References:

1 – Dirr, Michael A. and Charles W. Heuser, Jr. 1987. The Reference Manual of Woody Plant Propagation—From Seed to Tissue Culture. Varsity Press.

2 – U. S. Forest Service, USDA Ag. Handbook #450. 1974. Seeds of Woody Plants in the United States.

3 – Young, James A. and Cheryl G. Young. 1992. Seeds of Woody Plants in North America. Dioscorides Press. ISBN 0-931146-21-6

PRECAUTIONARY STATEMENT

To protect people and the environment, pesticides should be used safely. This is everyone's responsibility, especially the user.  
Read and follow label directions carefully before you buy, mix, apply, store, or dispose of a pesticide.  
According to laws regulating pesticides, they must be used only as directed by the label.  
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Pesticide registrations are continuously being reviewed. Should registration of a recommended pesticide be canceled,  
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